

FLOW-i anesthesia machine

Datasheet for system version 4.4

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FLOW-i anesthesia machine

Technical specifications

General

System model	C20	C30	C40
Base system weight (out of the box weight)	Appr. 138 kg/304 lbs	Appr. 140 kg/309 lbs	Appr. 140 kg/309 lbs
Dimensions of base plate	692x985 mm (27.2"x38.8")	692x985 mm (27.2"x38.8")	406x897 mm (16.0"x35.3") Measured over table-top and grips
Height (1 drawer)	N/A	835–1025 mm (32.9"–40.4") Adjustable	632 mm/ 24.9"
Height (2 drawers)	860 mm/ 33.9"	N/A	802 mm/ 31.6"
Height (3 drawers)	1030 mm/ 40.6"	N/A	N/A
Drawers	2–3 (1 lockable)	1 (lockable)	1–2 (1 lockable)
Vertical shafts for optional horizontal rails	4	4	4
Wheels	Four wheels (diameter 150 mm/5.9") with separate brakes	Four wheels (diameter 150 mm/5.9") with separate brakes	Three wheels (diameter 50 mm/2.0")
Working surface/writing table	Appr. 420x600 mm (16.5"x23.6")		
Additional writing table	397 mmx250 mm (15.6"x9.8")		
Reading lamp	Adjustable LED light integrated into the display arm		

Display

Type	LED touch screen, complete with 11 membrane switches and one rotary knob
Size	432 mmx295 mm (17.0"x11.6")
Placement	Attached to display arm
Viewing area	15", 1024x768 pixels with a palette of 512 colors
Waveforms	Up to 6 waveforms, user configurable
Trends	Graphic display, 1 to 24 hour resolution Numeric display, 1 to 60 minute resolution

Environment

Environment	Operating conditions	Non-operating conditions
Ambient temperature	+15°C to +35°C (+60°F to +95°F) (Desflurane: +15°C to +30°C, +60°F to +85°F)	–25°C to +60°C (–15°F to +140°F)
Battery	+15°C to +35°C (+60°F to +95°F)	+5°C to 40°C (40°F to 104°F)
Relative humidity (non-condensing)	15% to 95%	< 95%
Atmospheric pressure	700 hPa–1060 hPa	470 hPa–1060 hPa

Maximum load

Accessory/option	C20, max load (kg/lbs)	C30, max load (kg/lbs)	C40, max load (kg/lbs)
Additional writing table	5/11	5/11	5/11
Drawer	5/11	5/11	5/11
Patient monitor mounting position	13.5/30	13.5/30	13.5/30
Auxiliary O ₂ & Suction module mounting position	2.5/5.5	2.5/5.5	2.5/5.5
Parameter box support arm	5/11	5/11	5/11
Working surface/ writing table	20/44	5/11	5/11
4 vertical shafts	5 kg/11 lbs per shaft	5 kg/11 lbs per shaft	5 kg/11 lbs per shaft
Horizontal rails for hanging accessories	3/6.6	3/6.6	3/6.6
Additional arm	12/26	12/26	12/26
Backup gas rack	14/31	14/31	N/A
Extra backup gas holder (incl. full gas cylinder)	7.5/16.5	7.5/16.5	7.5/16.5
Top shelf	20/44	20/44	20/44
Vaporizer holder	4/8.8	4/8.8	4/8.8
Universal bracket	N/A	30/66	N/A
Universal bracket (C20)	30/66	N/A	N/A
Cable support arm	0.5/1.1	0.5/1.1	0.5/1.1

Standards – safety and functionality

Safety	IEC 60601-1 (Class 1, Type B) IEC 60601-1-2 IEC 60601-1-8 ISO 80601-2-13 IEC 62304 ISO 5360
Electromagnetic compatibility	IEC 60601-1-2
Respiratory gas monitoring	ISO 80601-2-55
Anesthetic gas delivery	ISO 80601-2-13
Usability	IEC 62366
Cleaning Classification according to IEC 60601-1:	IEC 60601-1 ISO 80601-2-13
Class I equipment	According to the type of protection against electrical shock
Type B equipment	According to the degree of protection against electrical shock
Continuous operation	According to the mode of operation (no applicable to the lift, 10% duty cycle)
Classification according to EU Medical Directive 93/42/EEC	The anesthesia system is classified as IIb
Classification according to IEC 60529 Ingress Protection Rating (IP)	IP21

Power supply

Mains power

Mains power	100–120V, 220–240V, AC 50–60Hz
Power consumption (C30)	500 VA (auxiliary power outlet not included)
Power consumption (patient monitor and maximum auxiliary configuration)	1220 VA

Battery

Type	Sealed acid-lead rechargeable
Capacity	38 Ah
Operating time	Appr. 90 minutes
Charging time	Appr. 6 hours

Auxiliary power outlets (option)

Power outlet	All auxiliary outlets and the patient monitor outlet are connected to an isolation transformer. Voltage depends on mains power supply	
Type of electrical outlet	Max load from each	Max load total
3xIEC outlets	2A (230V)/4A (110V)	2A (230V)/4A (110V)
1xIEC patient monitor power cable	1A (230V)/2A (110V)	1A (230V)/2A (110V)
3x15A NEMA 5-15R (Option)	2A-1A-1A (110V)	2A-1A-1A (110V)
Type of auxiliary power outlet	Country specific	
Type of patient monitor outlet	IEC cable	
Type of use	Electronic circuit breakers: 3x1A and 1x3A	
Auxiliary power outlets with protective earth	3 (max 1A per outlet)	
Total current	Max 3A	

Gas supply inlets and gas outlets

Central gas

Supply pressure inlet	Air/O ₂ /N ₂ O	250–650 kPa/ 2.5–6.5 bar/ 36–94 PSI
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Hospital central gas supply must be able to deliver a flow of at least 60 l/min at a supply pressure of 2.8 bar (280 kPa, 41 PSI)

Connection standards	AGA DISS NIST French standard
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Maximum levels	Air H ₂ O <7 g/m ³ Oil <0.5 mg/m ³ Chlorine must not be detectable	O ₂ H ₂ O <20 mg/m ³
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Maximum inlet gas temperature	<35°C (<95°F)
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Gas supply outlets

O ₂ outlet	Dependent on central gas supply pressure or cylinder inlet pressure
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Air outlet	Dependent on central gas supply pressure or cylinder inlet pressure
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Backup gas supply (option)

Pin Index cylinders (5 l)	Electronically measured cylinder pressure, Quick-release system for docking and release
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Weight and size (backup gas rack)	Appr. 20 kg/44 lbs excluding gas cylinders, 320 mmx730 mmx220 mm (12.6"x28.8"x8.7") (WxHxD)
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Cylinder configuration (backup gas rack)	Max 2 cylinders: O ₂ /N ₂ O or O ₂ /Air
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Cylinder configuration (backup gas holder)	N ₂ O, O ₂
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Cylinder pressure, O ₂ /Air	Max. 20,000 kPa/200 bar/2900 PSI
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Cylinder pressure, N ₂ O	Max. 8,000 kPa/80 bar/1160 PSI
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Cylinder safety valve opening pressure	Air/ O ₂ and N ₂ O	650 kPa/6.5 bar/94 PSI
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All gases and anesthetic agents must conform to the European and American Pharmacopeia

Anesthesia gas scavenging (AGS)

Type	Passive system (including a flow indicator) integrated into the system
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Scavenging flow	Minimum 25 l/min, or 10 l/min over the set minute volume, whichever is greater
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Outlet connections	<ul style="list-style-type: none"> • 30 mm ISO taper • DISS EVAC • 12.7 mm/1/2" in hose Barb • 25 mm/1" Barb • AGA EVAC • WAGD-to-Vacuum connector • 22 mm out. diam. connector and 22 mm int. diam. connection tube
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AGC parameters (option)

Target FiO ₂ concentration	30%–80%, MAX ¹
Setting resolution	1%
Target EtAA concentration	Isoflurane: OFF, 0, 0.3%–MAX ² Sevoflurane: OFF, 0, 0.3%–MAX Desflurane: OFF, 0, 1.0%–MAX
Setting resolution	0.1%
Speed parameter	1–8, MAX
Setting resolution	1
maxFiAA	Isoflurane: Min ³ –5% Sevoflurane: Min–8% Desflurane: Min–18%
Setting resolution	0.1%
minFGF ⁴	0.1–2.0 l/min
Setting resolution	0.1 l/min

AGC ventilation parameters (option)

Tidal Volume	100–800 ml
Minute Volume	1–10 l/min
Respiratory Rate	8–35 breaths/min ⁵
T _{insp}	>0.6 s
T _{exp}	>1.0 s
Pressure above PEEP	5–40 cmH ₂ O

Recruitment maneuvers (option)

Monitoring and trends

End inspiratory pressure (EIP)	Breath-by-breath
Positive end expiratory pressure (PEEP)	Breath-by-breath
Dynamic compliance (Cdyn)	Breath-by-breath
RM trends timescale	5 or 20 minutes
Set Ppeak alarm limit	The level is plotted with the pressure curves.
Breath count	The number of breaths is counted at a certain level of PEEP or PC above PEEP until a further change of these parameters is made.

Recruit maneuvers parameters

Ppeak target	30 to 45 cmH ₂ O
PEEP target	15 to 40 cmH ₂ O
PEEP after RM	5 to 20 cmH ₂ O
Ppeak increase per step	2 to 10 cmH ₂ O
Breaths per step	1 to 10
Breaths at target	3 to 30
I:E during RM	1:3.0 to 3.0:1

1. MAX is approximately 100% –current inspiratory anesthetic agent concentration

2. Highest allowable setting corresponds to a MACage of 2.0

3. Must be set higher than target EtAA

4. Individually set for each agent, and No agent'

5. RR is limited by T_{insp} and T_{exp}

Fresh gas flow

Gas mix	Air/O ₂ O ₂ /N ₂ O	Electronic Servo controlled Electronic Servo controlled
Fresh gas flow range	<ul style="list-style-type: none"> MAN = 0.1–20 l/min AUTO = 0.1–20 l/min (FGF delivery depending on set MV) AFGO = 1.0–20 l/min 	
Fresh gas O ₂ /Air Flow (numerical/bargraph)	Selectable	
Fresh gas O ₂ /N ₂ O Flow (numerical/bargraph)	Selectable	
Preset O ₂ concentration	Air/ O ₂ O ₂ /N ₂ O	21%–100% ±5% 28%–100% ±5%
O ₂ Flush	<ul style="list-style-type: none"> Appr. 50 l/min 2 cmH₂O expiratory resistance when APL is set to SP 	

Breathing system

Type	Circle system with Volume Reflector	
System volume (incl. absorber, without patient tubings and manual breathing bag)	Appr. 2.9 l	
Maximum volume allowed for patient tubings and optional equipment forming part of the circle system	3000 ml	
Drive gas	O ₂	
CO ₂ absorber	Volume Absorbent material	Appr. 0.7 l Sofnolime™
Patient tube connections	22/15 mm ISO cone	
Type of material (breathing circuit system)	PPSU (Polyphenylsulphone)	
System compliance (volume of gas lost due to internal compliance - manual mode only)	Appr. 3 ml/cmH ₂ O	

Manual ventilation

Electronic APL valve	Spontaneous breathing (SP) and adjustable pressure up to 80 cmH ₂ O
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AFGO- Additional Fresh Gas Outlet (option)

Type	22 mm coaxial/15 mm conical outlet connections Pneumatic powered SW controlled (from control panel)
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Emergency backup ventilation

Emergency APL valve	SP–80 cmH ₂ O
O ₂ emergency flow	0–10 l/min

Ventilator

Type	Pneumatic powered Servo controlled	
Patient range	Neonatal to Adult	
Ventilation modes	<ul style="list-style-type: none"> • Manual/Bag • AFGO (option) • Volume Control (VC) • Pressure Control (PC) • Pressure Support (PS, option) • Pressure Regulated Volume Control (PRVC, option) • Synchronized Intermittent Mandatory Ventilation (SIMV, option) 	
Tidal volume (VT)	20–2000 ml \pm 10% of actual value or 10 ml, whichever is greater. Note that the FLOW-i delivers tidal volumes down to 5 ml when using Pressure Control.	
Tidal volume setting range	Infant range: 20–350 ml, resolution 1 ml Adult range: 100–2000 ml, resolution 10 ml	
Minute volume setting range	Infant range: 0.3–20 l/min Adult range: 0.5–60 l/min	
Inspiratory pressure (pressure controlled modes)	0–120 cmH ₂ O	\pm 15% or \pm 2 cmH ₂ O, whichever is greater
Inspiratory pressure setting range	Infant range: 0–80 cmH ₂ O, resolution 1 cmH ₂ O Adult range: 0–120 cmH ₂ O, resolution 1 cmH ₂ O	
Compressible volume compensation	Yes	
Inspiratory flow	Maximum 3.3 l/s (200 l/min)	
Breathing frequency	4–100 \pm 1 breaths/minute	
I:E (VC, PC)	1:10–4:1	
PEEP	0–50 cmH ₂ O	
Trigger	Flow/Pressure	
Inspiratory pause (VC)	0 to 30% or 0–1.5 s	

Respiratory monitoring

Administered breaths	1–100 \pm 1 breath/minute
Loops	Flow–Volume Volume–Pressure Additional display options include having a reference loop and/or the last two loops shown together with the real-time loop
Lung characteristics	Airway resistance (Rdyn) Compliance (Cdyn) Elastance (Edyn)
Inspiratory Minute Volume	0.3–60 l/min \pm 15% or \pm 15 ml multiplied by the breathing frequency, whichever is greater
Expiratory Minute Volume	0.3–60 l/min \pm 15% or \pm 10 ml multiplied by the breathing frequency, whichever is greater
Inspiratory Tidal Volume	5–2000 ml
Accuracy Insp. Tidal Volume	\pm 4 ml (5–20 ml range) ⁶ \pm 15% or 10 ml, whichever is greater (20–2000 ml range)

6. Accuracy valid for O₂/Air gas mix, O₂ concentration at 60%, RR at 30 and I:E \geq 1:2

Respiratory monitoring (continued)

Expiratory Tidal Volume	5–2000 ml
Accuracy Exp. Tidal Volume	+7/–4 ml (5-20 ml range) ⁶ ±15% or 15 ml, whichever is greater (20–2000 ml range)
Mean Airway Pressure	0–100 cmH ₂ O
Peak Airway Pressure	0–140 cmH ₂ O
End Expiratory Airway Pressure	–40–100 cmH ₂ O
Airway Pressure	–30–140 cmH ₂ O
Airway pressure accuracy (applicable to all pressure measurements)	±5% of actual value or ±2 cmH ₂ O, whichever is greater

6. Accuracy valid for O₂/Air gas mix, O₂ concentration at 60%, RR at 30 and I:E ≥1:2

Alarms

Airway pressure: High	10–120 cmH ₂ O
Expiratory Minute Volume: High	0.5–60 l/min
Expiratory Minute Volume: Low	0.01–40 l/min
Excessive leakage (automatic mode only)	The difference between the maximum and minimum pressures during inspiration is too low
Continuous APL pressure (manual mode only)	Activated when the measured airway pressure exceeds predefined values for more than 15 seconds. Predefined values depend on current APL setting.
High continuous pressure (automatic mode only)	Airway pressure is constant above set PEEP level +15 cmH ₂ O more than 15 seconds
Negative airway pressure	Measured airway pressure is below -10 cmH ₂ O for more than one second
Regulated Pressure Limited (PRVC mode only)	Permissible pressure limits pre-set tidal volume
PEEP: High	0–55 cmH ₂ O
PEEP: Low	0–47 cmH ₂ O
Respiratory Rate: High	1–140 B/min and OFF
Respiratory rate: Low	1–140 B/min and OFF
Apnea	5–45 s. and OFF
Long apnea (manual mode only)	No breath detection for up to 120 s
Backup ventilation	Pressure controlled administered breath detected in pressure support backup mode due to time out of the backup respiratory rate parameter
Check breathing circuit	Activated when inspiratory and expiratory pressures fail to meet preset requirements
Battery operation - battery capacity unknown	Connection error; unable to estimate battery time
Limited battery capacity	Less than 18 minutes left of battery operation
No battery capacity	Less than 3 minutes left of battery operation
Water trap missing/ Replace water trap	The gas analyzer has detected that a water trap replacement is needed

Gas alarms

	Lower limit setting range	Upper limit setting range
Inspiratory O ₂ concentration alarm	18–99%	23–99% and OFF
Expiratory O ₂ concentration alarm	10–99% and OFF	13–99% and OFF
Inspiratory CO ₂ concentration alarm	---	0.1–10%
Expiratory CO ₂ concentration alarm	0.1–9.9% and OFF	0.1–10%
Inspiratory AA concentration alarm	0.1–5.0% and OFF (ISO) 0.1–8.0% and OFF (SEV) 0.1–18% and OFF (DES)	0.1–5.0% (ISO) 0.1–8.0% (SEV) 0.1–18% (DES)
Expiratory AA concentration alarm	0.1–4.0% and OFF (ISO) 0.1–6.0% and OFF (SEV) 0.1–12% and OFF (DES)	0.1–5.0% and OFF (ISO) 0.1–8.0% and OFF (SEV) 0.1–18% and OFF (DES)
Agent mixture: MAC > 3	The MAC of the secondary agent is ≥0.6 and the total MAC value is ≥3	
High continuous MAC	Measured MAC exceeds time limit: MAC >2.2; from starting a New Case, until 15 minutes after the first vaporizer activation. MAC >1.8 otherwise ⁷	
Agent mixture	The second agent is MAC ≥0.6 and the total MAC value is <3	
Insp N ₂ O: High	Inspiratory N ₂ O gas supply >80%	
Occlusion in sampling line	Detected occlusion reported from Y-piece gas analyzer	

Vaporizer

Agents	Isoflurane, Sevoflurane and Desflurane	
Type	Electronic Injector	
Weight (full)	Appr. 3.2 kg/7.1 lbs	
Dimensions (mm/inch.)	70x215x178 (2.8"x8.5"x7.0")	
Capacity	300 ml	
Residual capacity	30 ml (triggering the low level alarm)	
Setting range	Isoflurane Sevoflurane Desflurane	0, 0.3–5%, OFF 0, 0.3–8%, OFF 0, 1.0–18%, OFF
Accuracy	±15% of set value or ±5% of maximum possible user setting (whichever is greater)	
Filling system	Isoflurane Sevoflurane Desflurane	<ul style="list-style-type: none"> • Maquet filling adapter • Quik Fil® and Maquet filling adapter • SAFE-FIL™
Vaporizer filling speed	Appr. 4 ml/s	
Overfill protection	Overfilling prevention systems built into the vaporizer	
Tank liquid level	Optical and electronic	
Agent usage tracking	<ul style="list-style-type: none"> • Individual agent usage for each of the last 20 patient cases • Total agent usage since last user reset 	

Patient gas analyzer

Measuring technology	O ₂ Agents, CO ₂ , N ₂ O	Paramagnetic sensor IR sensor
Warm-up time	ISO standard accuracy Full accuracy	Within 60 s Within 10 minutes
Sampling flow and tolerance	225 ml/min ±10% (Return to circuit), BTPS condition	

Measured parameters

Resp. rate	2–100 breaths/minute	
Respiration rate measurement accuracy	<60 breaths/minute >60 breaths/minute	± 1 breath/minute Unspecified
Gas measuring range	O ₂ N ₂ O CO ₂ Isoflurane Sevoflurane Desflurane	0–100% 0–80% 0–10% 0–5% 0–8% 0–18%
Inspiratory and End-Tidal O ₂ Concentration	Yes	
Inspiratory and End-Tidal CO ₂ Concentration	Yes	
Inspiratory and End-Tidal N ₂ O Concentration	Yes	
Inspiratory and End-Tidal Agent Concentration	Yes	
Automatic AA identification	Yes. Agent mixtures are displayed containing a Primary and Secondary agent (classification depending on relative agent concentration)	

Patient suction and auxiliary O₂ module (option)

Weight	Appr. 2.2 kg/4.9 lbs
Patient suction supply pressure (Air)	300-650 kPa/3-6.5 bar/44-94 PSI
Auxiliary O ₂ supply pressure	300-650 kPa/3-6.5 bar/44-94 PSI
Auxiliary O ₂ flow range	0–15 l/min
Max. vacuum (suction)	–60 kPa down to –90 kPa at a supply pressure ranging from 3.0 to 6.5 bar
Max. suction flow	28 NI/min Note that normal liter (NI) is the volume of gas given ambient conditions, e.g. current atmospheric pressure

Misc. optional equipment

Vaporizer holder	
Weight	Appr. 0.8 kg/1.8 lbs
Weight including full vaporizer	Appr. 4.0 kg/8.8 lbs
Dimensions	90x220x215 mm/3.5"x8.7"x8.5" (WxHxL)

Universal bracket for C20

Weight	Appr. 2 kg/4.4 lbs
Maximum load	30 kg/66 lbs

EVAC restrictor

Weight	Appr. 60 g/2 oz
Dimensions	32x48x48 mm/1.3"x1.9"x1.9" (WxHxL)

Manual breathing bag support arm

Weight	Appr. 1.0 kg/2.2 lbs
Maximum load	1.0 kg/2.2 lbs

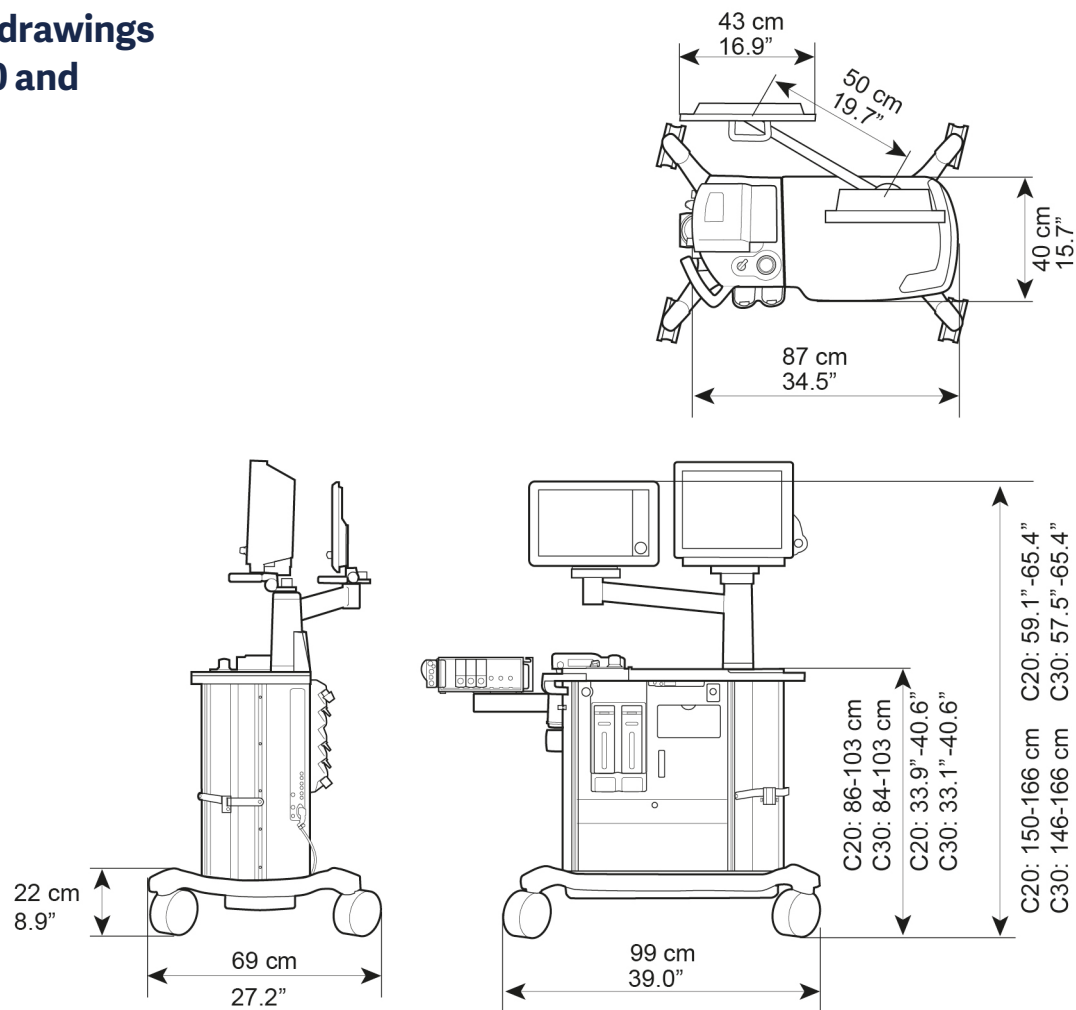
External communication

Serial ports	2xRS232	FCI protocol
USB	1	
Video out	1 VGA	
Ethernet	1 Network connection for service use	

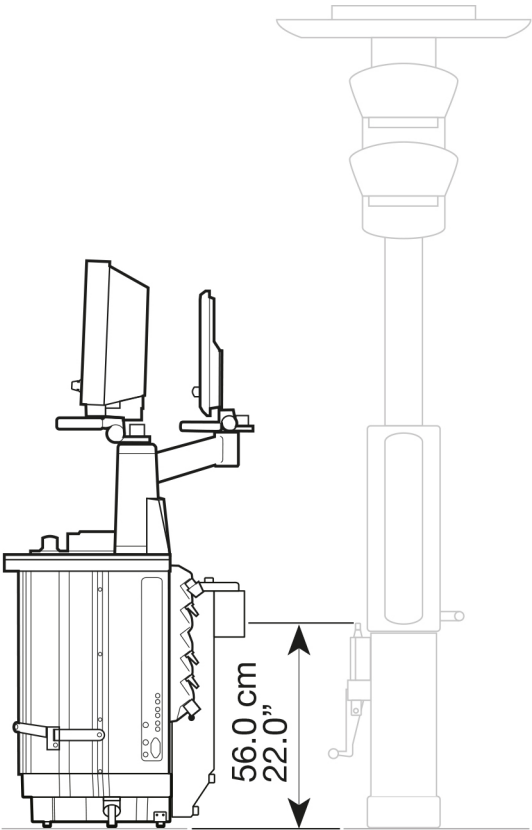
Ordering information

FLOW-i anesthesia system and accessories:
See separate information in "System flowchart, FLOW-i", mx-6924.

Dimensional drawings (showing C20 and C30 models)



Dimensional drawing (showing C40 model)





FLOW-i may be pending regulatory approvals to be marketed in your country. Contact your Getinge representative for more information. This document is intended to provide information to an international audience outside of the US.

Getinge is a global provider of innovative solutions for operating rooms, intensive care units, sterilization departments and for life science companies and institutions. Based on our firsthand experience and close partnerships with clinical experts, healthcare professionals and medtech specialists, we are improving the everyday life for people, today and tomorrow.

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